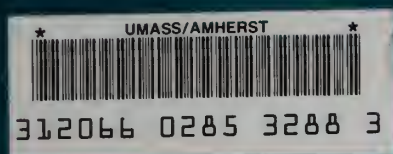


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*FOSTERING INNOVATIVE TECHNOLOGY THROUGH
A UNIQUE PARTNERSHIP AMONG:*

- EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
- DEPARTMENT OF ECONOMIC DEVELOPMENT
- UNIVERSITY OF MASSACHUSETTS

STEP

MASSACHUSETTS
STRATEGIC ENVIROTECHNOLOGY
PARTNERSHIP

1997 ANNUAL REPORT

March 1998

To the People of the Commonwealth:

In its third year, the Massachusetts Strategic Envirotechnology Partnership (STEP) achieved continued success in promoting the development of innovative technologies and fostering the growth of the state's burgeoning environmental industry. This unique partnership—launched in 1994 by the Massachusetts Executive Office of Environmental Affairs, the Massachusetts Department of Economic Development, and the University of Massachusetts—has begun yielding significant benefits for Massachusetts companies, the people of Massachusetts, and the environment.

The STEP program was conceived with the recognition that Massachusetts has the potential to become a leader in providing solutions to the world's environmental problems. Massachusetts has a state government eager to work with the private sector to speed the development of innovative environmental technologies, a state university system with top-quality faculty and cutting-edge environmental research facilities, and a host of innovative companies seeking to solve environmental problems.

Through the STEP program, we are breaking down barriers to technology innovation and helping environmentally responsible businesses grow. With support from STEP, our state university is partnering with manufacturers across the Commonwealth to test new technologies for making their operations cleaner and less wasteful. In addition, under the STEP program, the state is providing valuable technology testing and verification for numerous early-stage environmental companies in Massachusetts.

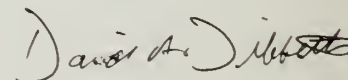
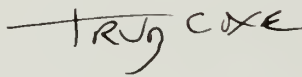
STEP is also assisting these companies in formulating effective business plans, which will enable them to attract funding to support their continued growth. Likewise, STEP is working with manufacturers and environmental companies to help them understand the state's regulatory environment and facilitate environmental demonstration projects.

This year's annual report illustrates just how valuable the program is to the state's manufacturing businesses and start-up companies. For every dollar that the Massachusetts Legislature has appropriated to the STEP program in FY 1997, nearly four dollars have been leveraged in company contributions and outside financing. We look forward to the continued success of this unique partnership as an engine of technological innovation and environmental improvement.

William M. Bulger

Trudy Coxe

David A. Tibbetts



President
University of Massachusetts

Secretary
Executive Office of Environmental Affairs

Director
Department of Economic Development



1997 STEP ANNUAL REPORT

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THE STEP INITIATIVE

Fostering Innovative Environmental and Energy Technology in Massachusetts

"STEP has been instrumental in fostering practical, hands-on results."

***High-Tech
All-Star Award
Mass High Tech***

During the past few decades, the environmental industry has become a major sector of the Massachusetts economy, accounting for about 33,000 jobs and more than \$4 billion in revenue each year. Recognizing the importance of this essential industry, Massachusetts launched the Strategic Envirotechnology Partnership (STEP), a unique collaborative effort among three key state agencies—the Executive Office of Environmental Affairs (EOEA), the Department of Economic Development (DED), and the University of Massachusetts (UMass).

Through the STEP initiative, EOEA, DED, and UMass work together as partners to facilitate the development and use of innovative environmental and energy-efficient technologies. These agencies assist environmentally responsible companies at every stage of development, from new start-ups testing an innovative product or process, to established companies looking for ways to reduce pollution, save energy, and increase efficiency.

In 1997, almost 100 companies received some type of STEP assistance in either developing or deploying innovative technologies. Among these companies, four start-ups received about \$4 million in outside financing obtained in part with STEP assistance. Three of these companies—Erickson Materials (Woburn), Ion Signature Technology (Cambridge), and SolmeteX (Billerica)—are profiled in this report. In addition, 25 established manufacturing companies contributed about \$725,000 in matching funds for waste minimization projects using new technologies.

STEP MAKES A DIFFERENCE

For every STEP dollar devoted to assisting start-up technology companies in 1997, those companies leveraged that support into four dollars in outside financing, and for every STEP dollar devoted to assisting manufacturing companies, those companies contributed another dollar to the projects. In this way, the STEP program has succeeded in using state resources to attract additional private support for commercializing innovative technologies.

In July 1997, the Massachusetts legislature increased its annual support for STEP from \$1.5 million in FY 1997 to \$2.0 million in FY 1998. This greater funding will help meet the growing demand from the private sector for STEP services and encourage the increased leveraging of private funds and other financial support by STEP companies.

STEP RECEIVES ALL-STAR AWARD FROM MASS HIGH TECH

On July 6, 1997, STEP received the "High Tech All-Star Award" from Mass High Tech, New England's high technology newspaper, for STEP's activities in promoting environmental technology. The All-Star Award is given to exemplary programs and individuals in various categories, and STEP received the award in the "environmental technology" category. According to Mass High Tech, "STEP is applauded by industry participants who say it is breathing new life into fledgling environmental technology firms." In addition, Mass High Tech said that "STEP has helped at least a handful of local firms to get to the commercialization stage" and that "STEP has been instrumental in fostering practical, hands-on results."

BROAD ARRAY OF STEP SERVICES

STEP offers a broad array of services tailored to the specific needs of each company. Page 15 contains a listing of the almost 100 companies that received assistance from STEP during 1997.

■ *Business Support*

The STEP program has helped emerging companies refine their business plans, target niche markets for their products, and identify potential sources of financing. STEP has also established internship programs, in which UMass students provide support to environmental technology firms.

■ *Regulatory and Permitting Assistance*

Through regulatory reviews, STEP agencies help entrepreneurs identify the regulations that apply both to their new technologies and to their potential customers' businesses. In the process, STEP companies gain a clearer understanding of the potential obstacles and opportunities for their technologies. The Department of Environmental Protection also provides expedited reviews of permit applications to help STEP technologies reach the marketplace sooner.

■ *Technology and Business Assessments*

STEP's business and technology assessments are designed to verify the cost, performance, and potential markets for innovative technologies, and to evaluate the company's management and business model. Although STEP assessments do not provide endorsements of specific technologies, they do identify the potential benefits of the technologies. Several companies have used favorable STEP assessments to attract financing and market their products to potential customers.

■ *Applied R&D Projects*

Since STEP's inception, UMass faculty members have worked with scientists from the government and private sector on applied research and development (R&D) projects to find cost-effective approaches to cut pollution and conserve energy. These projects have strengthened ties between UMass and its industry partners, and have honed the research skills of the UMass faculty and students who have participated in the projects.

■ *Demonstration Projects*

Each year, STEP agencies support a number of demonstration projects, in which environmental technology companies are able to test and improve their technologies, and collect performance data to support their claims. Demonstration projects at state facilities have the added advantage of introducing promising environmental technologies to state officials who are responsible for environmental monitoring and cleanup.

■ *Access to Interstate and International Markets*

The STEP program is committed to promoting the acceptance of innovative environmental technologies in other states and in the global marketplace. Toward this end, Massachusetts and five other states—California, Illinois, New Jersey, New York, and Pennsylvania—established in 1996 the Six-State Partnership for Environmental Technology.

STEP also supports efforts to reduce barriers to international trade in environmental technologies. In June, STEP officials participated in a meeting of NAFTA's Commission for Environmental Cooperation, at which environmental ministers and other interested parties began coordinating technology verification programs in Canada, Mexico, and the United States.

ENVIRONMENTAL MANAGEMENT

TECHNOLOGIES, INC.

State-of-the-Art System for UST Management

"EOEA has arranged SiteWatch presentations with state facility managers and transportation agencies such as MassHighway and MBTA."

***Bruce Share
Chief Executive Officer
Environmental
Management
Technologies, Inc.***

Working underground storage tanks (USTs) are the most common source of groundwater contamination in the United States. Since the late 1980s, more than 320,000 spills have occurred from the nation's one million federally regulated USTs, according to the U.S. Environmental Protection Agency (EPA). About 60 percent of these releases have affected groundwater, which is the source of drinking water for about half of all Americans.

Tank owners—including government agencies—that fail to comply with the UST regulations may be subjected to large penalties. For example, EPA fined the town of Weymouth nearly \$152,000 in 1997 for multiple violations of the federal UST standards. By December 22, 1998, tank owners must comply with federal regulations requiring the upgrading of tank systems and the implementation of leak-detection methodologies. Beyond compliance requirements, tank owners face the reality of environmental and financial liability, and the need to improve the management of their tank systems.

Environmental Management Technologies, Inc. (EMT) in Milton has designed its "SiteWatch" management service to help UST owners with their inventory and tank-management requirements, protect environmental and financial resources, and meet regulatory compliance requirements. On a daily basis, SiteWatch automatically collects, stores, and analyzes tank and dispenser data, which are then reviewed by EMT's professional staff for potential problems. The tank owner will be notified quickly if any problems are identified. Primary customers are retail gas station chains, heating plants, and fleet owners with their own fueling facilities.

In response to EMT's request, STEP undertook a technology assessment of SiteWatch and concluded

that the system can help reduce environmental hazards through early leak detection.

EMT submitted the STEP assessment report and additional information to American International Group and Zurich Insurance Corporation, the nation's two largest UST underwriters, requesting them to classify SiteWatch as a risk-management system. Both companies concluded that SiteWatch customers are eligible for the maximum premium discount, potentially \$500 per year per site, almost half the typical annual service fee for the basic service. By early 1998, EMT had 20 sites operational.

"Insurers now recognize our SiteWatch system as an important risk-management tool for UST owners, thanks in large part to STEP's technology assessment," according to Bruce Share, EMT's chief executive officer.

EMT has also been working with STEP to develop a strategy for marketing SiteWatch to state facilities. According to Share, "EOEA has arranged SiteWatch presentations with state facility managers and transportation agencies such as MassHighway and MBTA."

In March 1998, EMT acquired the worldwide exclusive licensing rights to another STEP technology—a fiber-optic hydrocarbon sensor from Ariano PetroTrace in Cambridge. "This patented technology can detect hydrocarbon leaks faster than any other instrument available," Share says. "With the addition of the Ariano sensor to our SiteWatch service, we have created the most comprehensive compliance, management, and leak-detection service in the industry," according to Share.

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

STEP

Encouraging Technological Innovation through Policy Changes

The Executive Office of Environmental Affairs (EOEA), the agency that sets environmental priorities in Massachusetts, coordinates the implementation of the STEP program. EOEA and its agencies work with STEP companies to help resolve the environmental, regulatory, and technical challenges that might otherwise prevent a promising environmental technology from reaching the marketplace.

Through STEP's technology assessment process, the Department of Environmental Protection (DEP) assists companies in identifying which federal and state regulations apply to their technology, as well as the types of performance data and other information that companies must provide to obtain permits for their systems.

For example, in regulatory reviews, DEP and EPA Region 1 determined that the CAST water treatment technology developed by Cellini Purification Systems, Inc. in Ludlow meets the federal requirements for a "totally enclosed" treatment system under the Resource Conservation and Recovery Act (RCRA). As a result, Cellini's CAST system may be installed in Massachusetts or any of the other five Region 1 states without a RCRA Part B permit.

STEP companies are also benefiting from EOEA's continued participation in the Six-State Partnership for Environmental Technology. EOEA selected Cellini and another STEP company—AWT Bioclere in New Bedford—to be part of a technology review pilot project under the auspices of the Six-State Partnership. In the pilot project, EOEA and the other states' environmental agencies conducted joint evaluations of 12 environmental technologies. The pilot project gave the six participating states the opportunity to learn about one another's technology evaluation procedures, identify areas where

their procedures differ or overlap, and begin reducing the redundancies and inconsistencies in their testing programs. This knowledge may make it possible to accelerate the permit process and timelines for companies that have already completed the full technology evaluation and permitting process in another state.

In addition, EOEA is working with other Massachusetts agencies to encourage the use of innovative environmental technologies in the Commonwealth. In April, EOEA and the Massachusetts Highway Department cosponsored a conference focusing on the site assessment, monitoring, and control technologies developed by four STEP companies: AirXpert Systems (Lexington); Ion Signature Technology (Cambridge); ORS/Sippican (Marion)—subsequently Osmonics purchased the technology; and URBAN Contamination (Wellesley). This technology conference was the first event at which STEP contractors had an opportunity to present their technologies to a large group of state officials responsible for the monitoring and cleanup of contaminated sites.

In cooperation with EOEA, the Operational Services Division (OSD)—the central purchasing office for Massachusetts—has established the goal of increasing the state's purchases of products made of recycled materials and other "environmentally preferable products," such as those that diminish energy consumption or reduce the amount of toxics generated. OSD's new procurement policy gives state agencies greater flexibility to consider in their purchasing decisions all factors that contribute to the cost of a technology or product—including its environmental and energy benefits.

ERICKSON MATERIALS, INC.

New Life for Scrap Tires

"STEP's favorable assessment of our technology helped us secure the financing for our first \$1.2-million pilot plant in Woburn."

***Scott Erickson
President
Erickson Materials, Inc.***

Tens of millions of old, damaged tires are disposed of in the United States each year. Scrap tires are an eyesore, take up valuable landfill space, and present both environmental and health risks. Tire fires in dumps sometimes burn for months, fouling the air and releasing an oily runoff that pollutes streams and aquifers. In addition, rainwater often collects in discarded tires, forming stagnant pools that are a breeding ground for mosquitoes.

Yet scrap tires are also a potential source of a valuable material—rubber—that can be reused. To date, however, rubber recycling has been limited, due to the inability of existing technologies to reduce the scrap rubber economically to sizes that have a high market value.

Enter Massachusetts entrepreneur Scott Erickson, who recognized the potential for both environmental benefits—and profits—if this challenge could be overcome.

"We've developed a technology that can reduce scrap rubber, whether from scrap tires or industrial rubber scrap, to a fine powder with the consistency of talc, in volume and at low cost," says Erickson, president of Erickson Materials, Inc. in Woburn. This powder can be incorporated into a variety of products, including tires and many types of extruded or molded rubber goods. "We expect to sell the powder for about half the price of virgin rubber," according to Erickson. The production of the rubber powder also uses only 2% to 6% of the energy used in making virgin rubber.

Soon after Erickson founded his company in early 1996, the Massachusetts Office of Business Development encouraged him to request a STEP assessment of the new technology. An assessment by UMass-Amherst's Center for Energy Efficiency and

Renewable Energy found that the technology was based on sound scientific principles. UMass-Boston's Environmental Business and Technology Center reviewed Erickson's business strategy, and concluded that the company "has a very good opportunity to succeed." To further assist the company, the Chelsea Center for Recycling and Economic Development has helped Erickson identify potential customers for the recycled rubber.

"STEP's favorable assessment of our technology helped us secure financing for our first \$1.2-million pilot plant in Woburn," according to Erickson. The sources of capital include a \$485,000 loan from MassDevelopment's Emerging Technology Fund and an additional \$150,000 from the Recycling Loan Fund, with the remainder from private investors. The facility, which was completed in early 1998, will convert 8 million pounds of scrap tires and industrial rubber scrap into rubber powder each year.

Erickson is already planning to build a second plant in Massachusetts at a cost of \$7 million and with a treatment capacity of 40 million pounds per year. Together, the two plants will keep over 2 million scrap tires out of landfills each year and add 30 to 60 new jobs to the Massachusetts economy.

DEPARTMENT OF ECONOMIC DEVELOPMENT

STEP

Promoting Economic Growth within the Environmental Sector

In keeping with its mission to promote job creation and long-term economic growth in Massachusetts, the Department of Economic Development (DED) provides business assistance to companies in the STEP program. DED is committed to helping emerging firms obtain the financial and technical resources that they need to develop and commercialize new environmental technologies.

Within DED, the Massachusetts Office of Business Development (MOBD) works directly with STEP companies, reviewing their business plans and helping them locate technical and financial resources. With MOBD's assistance, Erickson Materials received \$150,000 from the Recycling Loan Fund and \$485,000 from MassDevelopment's Emerging Technology Fund and then leveraged those funds to obtain more than \$550,000 in private financing to build and equip its first tire recycling plant in Woburn.

In addition, MOBD provides assistance to out-of-state firms considering relocating in Massachusetts or expanding into the state. To help such companies, MOBD offers information on tax incentives, financing options, and development programs available to businesses in Massachusetts.

As a STEP partner, DED's Division of Energy Resources (DOER)—recently transferred to the Department of Consumer Affairs—encourages the development and use of renewable-energy sources and energy-efficient technologies in Massachusetts. DOER provides extensive funding to the Center for Environmental Engineering and Renewable Energy (CEERE) at UMass-Amherst for technology assessments, research projects, and technical assistance under the STEP program (see page 9 for additional information).

DOER assists companies developing "green energy" technologies, including renewable-energy systems that provide electricity, heat, hot water, or fuels; energy-efficient products for buildings, industrial processes, or transportation; and fuel cells for both transportation and stationary applications. For such companies with promising but unproven technologies, DOER helps identify and secure grants for further research and development.

For emerging firms with technically viable technologies, DOER performs technology assessments and helps coordinate testing and demonstration projects. These projects can bring technologies a step closer to the marketplace by providing the field experience that companies need to attract investment financing.

For firms that have fully developed and tested their technologies, DOER gives technical assistance to help them successfully commercialize their products. DOER works with these companies to identify and overcome problems, such as restrictive regulations or government policies, that could keep their products from reaching the marketplace. For example, DOER may assist companies in changing state government procurement standards, as well as building and appliance codes, to facilitate the acceptance and use of innovative environmental technologies.

UNIVERSITY OF MASSACHUSETTS

STEP

Assisting Companies to Develop and Commercialize Emerging Technologies

Companies in the STEP program receive technical and management assistance from the various campuses of the University of Massachusetts system if the companies partner with the University on applied research and development projects, or if the Executive Office of Environmental Affairs or the Department of Economic Development refers them to the University for assistance. These companies benefit from the wide range of technical expertise available from the University's distinguished faculty and from the state-of-the-art research facilities at the University's main campuses.

Four of these campuses—Amherst, Boston, Dartmouth, and Lowell—have centers involved in fostering innovative technology and in assisting emerging companies. In addition, throughout the University of Massachusetts system, more than 50 faculty members participate in the STEP program as advisers and researchers.

Highlights of the work at the various centers on these four campuses include:

- An increase of 66 percent since 1995 in the number of projects that help industrial partners develop and test pollution-prevention technologies.
- The initiation of technology commercialization workshops, which assisted several early-stage companies in positioning themselves to obtain funding.
- A significant new assignment from the Massachusetts Legislature: developing a strategic plan to increase demand for the use of recycled materials in the Commonwealth.

UNIVERSITY OF MASSACHUSETTS-AMHERST

NATIONAL ENVIRONMENTAL TECHNOLOGY FOR WASTE PREVENTION INSTITUTE

Partnering with Industry to Prevent Pollution and Reduce Waste

The National Environmental Technology for Waste Prevention Institute (NETI) at UMass-Amherst works directly with industrial partners to develop new pollution-prevention and waste-reduction techniques for use in manufacturing.

These techniques include developing and redesigning plant equipment, modifying steps in the manufacturing process, and fine-tuning employees' work

procedures on the production line. When pollution-prevention efforts are backed by solid planning and research, companies are often able to meet their environmental goals while improving plant efficiency and reducing operating costs.

NETI research projects typically last more than one year and focus on fundamental manufacturing problems at the "proof-of-concept" level. UMass-Amherst

NETI INDUSTRY PROJECTS FUNDED IN FY 1998

	FUNDS	SUPPORT	INDUSTRY PARTNER(S)
Reduced isocyanate use in fabrication of polyurethane composites	\$54,665	\$55,000	GE Plastics (Selkirk, NY); GI Plastek (Newburyport); Shell Chemical Co. (Houston, TX)
Solvent-free polymer production using supercritical CO ₂	\$50,000	\$36,000	Procter & Gamble (Cincinnati, OH); Alza Corp. (Palo Alto, CA)
Waste reduction in methane oxidation processes	\$50,000	\$5,000	Praxair (Tarrytown, NY)
Waste prevention during semiconductor manufacturing	\$50,000	\$10,000	Morton International (Danvers)
Bacterial fermentation for polymer fabrication	\$46,500	\$13,000	3M (St. Paul, MN)
Microwave radiation and zeolite pore sieves for VOC recycling	\$54,700	\$25,000	ChemDesign Corp. (Fitchburg)
Honeycomb silica films for recovery of VOCs and hydrogen	\$50,000	\$5,000	DuPont Central Research & Development (Wilmington, DE)
Kinetics-based approaches for controlling NOx emissions	\$50,000	\$10,000	United Technologies Research Center (East Hartford, CT)
Improved designs to prevent waste in multiphase chemical reactors	\$49,971	\$95,000	Mitsubishi Chemical America (San Jose, CA); Morton International (Danvers); Searle (Skokie, IL)
Environmentally sound cooling techniques for grinding processes	\$47,300	\$47,500	Chand Kare Technical Ceramics (Worcester); Norton Co. (Worcester); Torrington Co. (Torrington, CT)

NETI INDUSTRY PROJECTS FUNDED IN FY 1997

	FUNDS	SUPPORT	INDUSTRY PARTNER(S)
Microwave radiation and molecular sieves for VOC recycling	\$59,200	\$34,300	ChemDesign Corp. (Fitchburg)
Techniques for reducing waste from batch solvent recovery processes	\$30,540	\$14,400	Polaroid Corp. (Waltham)
Kinetics-based approaches for controlling NOx emissions	\$49,000	\$25,000	United Technologies Research Center (East Hartford, CT)
Waste prevention in specialty chemical manufacturing	\$49,000	\$200,000	Searle (Skokie, IL)
Honeycomb molecular sieves for catalysis and separations	\$49,000	\$5,000	DuPont Central Research and Development (Wilmington, DE)
"Green" cooling techniques for grinding processes	\$44,000	\$82,762	Chand Kare Technical Ceramics (Worcester); MRC Bearings (Jamestown, NY); Norton Co. (Worcester)
Environmentally benign approaches for using scrap PET plastic	\$58,400	\$62,000	General Electric Corporate Research & Development (Schenectady, NY)
Design and use of elastomeric energy storage devices	\$47,000	\$22,000	Globe Manufacturing Co. (Fall River); Globe Rubber Works (Rockland)
Human health impact of reduced chemical exposures in Massachusetts	\$49,000	\$12,500	Polaroid Corp. (Waltham)

faculty researchers work with technical experts from one or more firms that serve as industrial partners for each project. The research costs are shared by NETI and the industrial partners, which may provide either in-kind or direct-dollar support.

The number of NETI-supported projects has increased every year, rising from six in FY 1995 to seven in FY 1996, nine in FY 1997, and ten in FY 1998. During this period, project teams have included faculty members, post-doctorates, and graduate students from the UMass-Amherst's Chemical Engineering Department, Electrical and Computer Engineering Department, Mechanical and Industrial Engineering Department, Microbiology Department, Polymer Science and Engineering Department, and School of Public Health and Health Sciences.

Although many Massachusetts companies have been industry partners in NETI projects, NETI has also worked with firms from several other states, including California, Connecticut, Delaware, Illinois, New Jersey, New York, and Texas. The table on the preceding page summarizes NETI research partnerships for FY 1997 and FY 1998.

NETI received national recognition in 1997 when the U.S. Environmental Protection Agency and the American Chemical Society selected NETI as one of four university research units to participate as an exhibitor at the first Green Chemistry and Engineering Conference held last June at the National Academy of Sciences in Washington, D.C. The exhibit highlighted NETI's university-industry research partnerships and UMass-Amherst faculty's expertise in pollution-prevention research.

CENTER FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY

Building a Sustainable Energy Future

The Center for Energy Efficiency and Renewable Energy (CEERE) at UMass-Amherst's Department of Mechanical and Industrial Engineering conducts technology assessments for the STEP program. CEERE's assessment work focuses primarily on companies with innovative products that make use of renewable energy sources or that increase energy efficiency.

CEERE also provides a variety of technical assistance to energy-related firms, such as suggesting improvements in product design, coordinating and evaluating demonstrations at pilot sites, identifying potential investors and purchasers, and meeting

regulatory requirements for the products. In addition, CEERE supports DOER's utility deregulation and restructuring efforts.

During 1997, CEERE provided technical assistance to a total of 15 companies, and performed technical assessments for the following eight STEP companies: Ariano PetroTrace (Cambridge); CSR/New England Pipe (Waughegan, CT); Erickson Materials (Woburn); Second Wind (Somerville); StormTreat Systems (Sandwich); Thermatrix (San Jose, CA); Twin Rivers Technologies (Quincy); and Vortech (Portland, ME).

ADVANCED TECHNOLOGY CENTER

Undertaking Applied R&D Projects for STEP

The Advanced Technology Center (ATC)—the focal point of STEP activities at UMass-Dartmouth—promotes the development of new technologies and products that are both environmentally sound and marketable. Another important ATC objective is to enrich the academic environment at UMass-Dartmouth by providing research opportunities for both faculty and students.

ATC and the UMass research community conduct applied research and development (R&D) projects, working in cooperation with STEP industry and government partners. ATC and its research partners are currently working on eight R&D projects. Two research areas addressed by the larger projects include the acoustic detection of pollutants and the off-site monitoring and control of distributed wastewater treatment systems.

Two smaller environmental research initiatives—an investigation of excessive aquatic plant growth contributing to pond eutrophication, and the impact of wastewaters from beauty parlors on groundwater resources—will be completed by early 1998. These investigations have support from concerned citizens and small businesses, as well as government and nonprofit agencies.

The total budget for the eight R&D projects is more than \$540,000, with \$320,000 provided to ATC by the STEP program, and an additional \$223,000 in the form of cash and in-kind contributions from industry and government research partners.

One of ATC's ongoing research projects involves establishing an R&D center for the design and testing of ground-source heat pumps (GSHPs), which extract heat from the ground. UMass-Dartmouth researchers are working with industry and the Massachusetts Division of Energy Resources to

develop and test prototype GSHP components and related instruments. GSHPs are renewable energy systems that conform to the Kyoto Protocol, which sets goals for cutting greenhouse gas emissions. The development of economical commercial and residential GSHP systems has the potential to reduce energy consumption and costs in Massachusetts and elsewhere and, at the same time, provide benefits to the environment.

In another research project, ATC is working with the STEP company AWT Environmental to develop a cost-effective system for monitoring and controlling small wastewater treatment systems. Many homes and small businesses in Massachusetts are installing these systems to conform to the new Title 5 legislation. UMass is involved in developing the instrumentation and software for the remote control of these systems, relieving homeowners and small business owners of this task.

ATC conducts technology assessments throughout the year in response to requests initiated by industry, the Executive Office of Environmental Affairs, and the Massachusetts Office of Business Development. During 1997, ATC and UMass-Dartmouth faculty conducted nine technical reviews under the STEP program. During FY 1998, ATC will receive a total of \$50,000 in STEP allocations to support technical assessments.

ION SIGNATURE TECHNOLOGY, INC.

Innovative Software for Rapid Chemical Analysis

"STEP played an essential role in arranging for a state laboratory to serve as one of our beta sites."

***Albert Robbat, Jr.
Chairman
Ion Signature
Technology, Inc.***

Before a waste site can be cleaned up, contractors must collect and analyze numerous soil and water samples to identify pollutants and determine their concentrations and distribution. Sample analysis is typically a time-consuming process that delays cleanups and substantially increases costs.

Ion Signature Technology, Inc. (IST) in Cambridge has developed innovative software to enhance the performance of gas chromatography/mass spectrometry (GC/MS) instruments, which are widely used for organic chemical analysis.

The company's patented Ion Fingerprint Detection™ (IFD) software can help analyze complex chemical samples without the extensive sample pretreatment usually required. As a result, sample analysis can be completed about four times faster and at about one-quarter the cost of conventional methods.

"Our IFD software will allow labs to analyze more samples per day with lower labor costs, which will dramatically increase their productivity and profitability," according to IST chairman Albert Robbat, Jr. "Fast and cost-effective sample analysis will also lead to better site characterizations and quicker cleanups, which will boost the site owner's bottom line while safeguarding public health."

Soon after IST sought STEP assistance in 1996, STEP contracted Battelle's Environmental Systems and Technology Division to perform a technology evaluation of IST's software. Battelle confirmed the technology's potential, as well as its dramatic productivity gains and cost savings. In addition, UMass-Boston's Environmental Business and Technology Center (EBTC) reviewed the company's business plan and recommended changes in the plan.

"STEP's business input helped to reposition the company to attract seed funding," according to Robbat. As a result of IST's favorable technology assessment and revised business plan, the company succeeded in raising more than \$500,000 to further develop the software and begin marketing it.

"STEP played an essential role in arranging for a state laboratory to serve as one of our beta sites," Robbat says. In 1997, the Massachusetts Department of Environmental Protection's Lawrence Experiment Station compared the performance of the IFD system and a software package developed by a major GC/MS instrument manufacturer.

The IFD software outperformed the other data analysis package in terms of speed and cost for all types of samples analyzed. The beta test also showed that the IFD software produced more accurate data for samples with high matrix interference, and equal-quality data for samples with minimal matrix interference.

In early 1998, IST received its first order for the IFD software. "We hope to continue working with STEP as our marketing efforts intensify," Robbat says. "As a result of STEP's involvement, DEP plans to hold a workshop where we'll have an opportunity to present our software to certified laboratories that operate in Massachusetts."

ENVIRONMENTAL BUSINESS AND TECHNOLOGY CENTER

Positioning Companies for Commercialization

The Environmental Business and Technology Center (EBTC) at UMass-Boston's College of Management provides technology verification and business strategy support to Massachusetts environmental technology companies. For STEP, EBTC spearheads the review and selection of companies seeking STEP services from one or more of the participating state agencies and UMass technology centers. EBTC also publishes STEP's quarterly newsletter titled *Massachusetts Environmental Ventures*, which is available on STEP's web site—www.mag-net.state.ma.us/step.—or by mail on request.

EBTC arranges the testing for the innovative technologies in the STEP program, either performing it directly or referring it to another research facility in the UMass system. Depending on the results, EBTC offers additional business assistance to the STEP companies involved.

During 1997, EBTC conducted or contributed to STEP technology assessments for 13 companies. State regulatory agencies often review these assessments when making permitting decisions for new technologies. Some state agencies also consult STEP assessments when choosing appropriate technologies for their monitoring, cleanup, or recycling projects. In addition, STEP companies have used these technology assessments to help establish credibility with potential investors and market their products to prospective customers.

Like all startup companies, new environmental technology firms must have a solid business plan and adequate financing to make the difficult transition from product development to commercialization. EBTC provides a variety of business assistance to help these companies achieve commercial success.

EBTC works with company officials to review the firm's technology, research and development efforts, marketing and sales strategy, organizational structure, and financial status. Based on this review, the EBTC team helps the company revise and expand its business plan, define target markets, identify competitive advantages, and develop a strategic plan.

As a direct result of EBTC assistance, Ion Signature Technology was able to obtain first-round financing to begin commercializing its Ion Fingerprint Detection™ software, which is used with gas chromatography/mass spectrometry (GC/MS) instruments to identify contaminants in environmental samples.

In 1997, EBTC also began conducting technology commercialization workshops to help start-up companies develop and refine their business strategies. One such workshop helped TBX, Inc. in Cambridge evolve a more focused marketing strategy for its cold-plasma technology, which is designed to recover greenhouse-gas emissions during the semiconductor-manufacturing process.

Another workshop assisted Innovative Chemical and Environmental Technologies (ICET) in Norwood to select which one of the company's technologies to commercialize first: a carbon-based sorbent system for removing trace metals from wastewater and drinking water. The workshop also helped ICET to develop a business strategy that proved essential in obtaining funds to develop the prototype.

SOLMETEX, INC.

Removing Heavy Metals at the Source

"I'd recommend the STEP program to any new environmental technology company — except, of course, our competitors."

***Owen Boyd
Chairman
Solmetex, Inc.***

Heavy metals, such as mercury, are serious water pollutants both in Massachusetts and nationwide. The U.S. Environmental Protection Agency has estimated that U.S. industries release about 160 tons of mercury into the atmosphere and waters each year. Chronic exposure to mercury contamination—as happened in Japan's Minimata Bay during the 1950s and 1960s—can cause severe neurological problems, including convulsions and paralysis, or even death.

Solmetex, Inc. in Billerica is helping to reduce emissions of mercury and other heavy metals by developing technologies that control these pollutants at the source. The company's Keyle:X™ and Metall:X systems use proprietary adsorbents to remove mercury and other metals from wastewater much faster than conventional systems, such as ion-exchange resins and carbon adsorbents.

"The high efficiency of Solmetex's adsorbent technology makes our products smaller and less costly than conventional wastewater cleanup systems," according to company chairman Owen Boyd.

Boyd believes that Solmetex technology can play a major role in reducing heavy metal pollution. For example, one Keyle:X unit now operating at a medical waste incinerator removes 22 grams of mercury per hour, or the equivalent of nearly 200 kilograms each year.

Solmetex was founded in 1994 and became involved with STEP in early 1996. "STEP has been with us through the key steps in our development, and has directly contributed to our growth," Boyd says.

The Environmental Business and Technology Center at UMass-Boston and the Center for Environmentally Appropriate Materials at UMass-

Lowell performed business and technology assessments for Solmetex, and concluded that both Keyle:X and Metall:X "are promising alternatives to conventional treatment technologies."

As part of a Massachusetts Water Resources Authority (MWRA) project, Solmetex tested a lab-scale system to remove mercury from hospital waste streams, and STEP helped MWRA verify the test results. The data from this project, together with the favorable STEP business and technology assessments, have helped Solmetex attract potential investors and customers. "The STEP program has greatly assisted Solmetex in bridging the credibility gap," says Boyd. "Without credibility, Solmetex would have gone out of business over a year ago."

Far from going out of business, Solmetex has secured \$1.5 million in venture capital financing, and sold systems to about 10 customers by early 1998. The company's clients include several hospitals, medical waste incinerators, a chrome plater, and a newspaper company. Solmetex has increased its staff from four to ten employees during the past year. One of the new hires is a UMass-Boston graduate who first worked at Solmetex as a STEP intern.

When asked about his overall experience with the STEP program, Boyd responded, "I'd recommend STEP to any new environmental technology company—except, of course, our competitors."

UNIVERSITY OF MASSACHUSETTS-LOWELL

STEP

CENTER FOR ENVIRONMENTALLY APPROPRIATE MATERIALS

Advancing the Adoption of Sustainable Technologies

The Center for Environmentally Appropriate Materials (CEAM) administers the STEP program at UMass-Lowell. The mission of CEAM is to promote the design and adoption of materials and processes that are safe, appropriate, and compatible with the environment. CEAM also facilitates the transfer of environmentally sound materials technology to reduce the generation of hazardous wastes.

In 1997, with financial support from STEP, CEAM and the state's Toxics Use Reduction Institute (TURI) launched the University's Research in Sustainable Technologies Program. This new program supports the research, development, and eval-

uation of sustainable technologies that are both economically and environmentally sound.

For FY 1998, the Sustainable Technologies Program has awarded eight grants totaling \$170,000 to support projects in the following areas of research: alternative-fuel systems for buses; enzyme-catalyzed modification of soy proteins; alternatives to PVC in medical applications; solid-state equipment for heating and cooling; additive technologies for the fabrication of printed wiring boards; de-inking system for waste paper; formation and properties of noncovalent hydroquinone derivatives; and hydrogen bonding of solvent-polymer pairs.

CHELSEA CENTER FOR RECYCLING AND

ECONOMIC DEVELOPMENT

Promoting the Use of Recycled Feedstocks

The Chelsea Center for Recycling and Economic Development provides a variety of technical and business assistance—such as reviewing business plans, identifying capital sources, and testing products and materials—to businesses and organizations that use, or are considering the use of, recycled feedstocks. For example, in 1997, the Chelsea Center linked Erickson Materials in Woburn with a rubber products manufacturer that is now sending its rubber scrap to Erickson for processing and taking back the recycled rubber for use in some of its products. The Chelsea Center also helped find and test recycled resin for use by Cambridge-based Recycline in its new toothbrush.

In addition, the Chelsea Center works with the state's Operational Services Division (OSD) to select products for OSD's Pilot Purchase Program, in which the state procures and asks agencies to try

out items made from recycled materials. In 1997, OSD awarded a contract to ShelTech Plastics in Haverhill for 1,350 recycled plastic hand and foot soaking basins that are now being used in state and municipal hospitals. Atlon Laboratories in Framingham also received an OSD contract for 200 plastic chock blocks—wedges that keep trucks from rolling away—which are being tested by the State Police, MassHighway, MassPort, Metropolitan District Commission, and municipalities.

During 1997, the Chelsea Center took on a significant new assignment: developing a strategic plan for the use of recyclable materials for the Commonwealth. The Chelsea Center is also assisting manufacturing companies to convert to recycled feedstocks, and is sponsoring applied R&D projects to increase the demand for recycling.

COMPANIES THAT RECEIVED

STEP ASSISTANCE DURING 1997

Whether requesting technology, business, or regulatory assistance, almost 100 companies took advantage of STEP's services during 1997. The level of STEP assistance varied among the companies listed below, but a common theme was the active support of the state system in helping to commercialize environmental technologies.

Acushnet Rubber (New Bedford)	Institute for Self-Active Education (Jamaica Plain)
Advanced Environmental Services (South Dennis)	Ion Signature Technology (Cambridge)
AirXpert Systems (Lexington)	J.A. Busa Air Conditioning and Refrigeration (Lexington)
Altron (Wilmington)	J.P. Routhier and Sons (Littleton)
Altus Biologics (Cambridge)	Kaman Industrial Technologies (Manchester, NH)
ALZA Corp. (Palo Alto, CA)	Mitsubishi Chemical America (San Jose, CA)
Ariano PetroTrace (Cambridge)	Moltek (Webster)
Atlon Laboratories (Framingham)	Morton International (Danvers)
AWT Environmental (New Bedford)	MRC Bearing Services (Jamestown, NY)
Benthos (North Falmouth)	Norton (Worcester)
Boston Scientific Corp. (Natick)	New Frontier Plastics (West Springfield)
Caldwell Environmental Unified Services (Acton)	Osmonics (Rockland)
Camber Corp. (Easton)	Pacific Crest Environmental (Bend, OR)
Cellini Purification Systems (Ludlow)	Parlex (Methuen)
Chand Kare Technical Ceramics (Worcester)	Pfizer (New York, NY)
ChemDesign Corp. (Fitchburg)	Physical Sciences, Inc. (Andover)
ChemMotif (Concord)	Polaroid (Waltham)
Civiera & Silver International (Holden)	Praxair (Tarrytown, NY)
C.R. Bard (Billerica)	Proctor & Gamble (Cincinnati, OH)
CSR/New England Pipe (Wareham, CT)	Recycline (Cambridge)
E.I. duPont de Nemours (Wilmington, DE)	ReHarvest (Concord)
East-West Foundation (Boston)	Searle (Skokie, IL)
Electronics Processing Associates (Lowell)	Sea Watch International (New Bedford)
Environmental Management Technologies (Milton)	Second Wind (Somerville)
Environmental Solutions International (Windsor)	Shell Chemical (Houston, TX)
Environmental Toxicology Labs (Groton)	ShelTech Plastics (Haverhill)
EnviroPlastics Corp. (Auburn)	Simulprobe Technologies (Mill Valley, CA)
Erickson Materials (Woburn)	Sippican (Marion)
Eureka! Ventures (Springfield, NJ)	Solectria (Wilmington)
Excalibur GlassWorks (Woburn)	SolmeteX (Billerica)
ForBest Cleaning Solutions (Hammond, LA)	StormTreat Systems (Sandwich)
Foster-Miller (Waltham)	Supply Solutions (Winchester)
Funn & Frolic (Edgartown)	Talbert Trading (Worcester)
Futuristic Tile (Allenton, WI)	TBX (Cambridge)
G & A Precycling (Fitchburg)	Thermatrix (San Jose, CA)
GE Plastics (Selkirk, NY)	3M (St. Paul, MN)
General Electric (Schenectady, NY)	Torrington Co. (Torrington, CT)
GI Plastek (Newburyport)	Tri-Star Technologies (Methuen)
Globe Manufacturing (Fall River)	Twin Rivers Technologies (Quincy)
Globe Rubber Works (Rockland)	United States Building Technology (Framingham)
Green Glass (Great Barrington)	United Technologies (East Hartford, CT)
G.T. Machine (Boxford)	URBAN Contamination (Wellesley)
Guardian Environmental Technologies (Kent, CT)	USM Texon Materials (Russell)
Hadco Corp. (Salem, NH)	Vortechnics (Portland, ME)
Heat Transfer Products (East Freetown)	Walden Paddlers (Concord)
High Temperature Technologies (Cambridge)	Walton & Lonsbury (Attleboro)
Innovative Chemical and Environmental Technologies (Norwood)	Western Bronze (West Springfield)
Innovative Recyclers (Chicopee)	Wright Industries (Toronto, Ontario)
	Zona Salons (Norwell)

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STEP

**MASSACHUSETTS
STRATEGIC ENVIROTECHNOLOGY
PARTNERSHIP**